

09/779,287 filed 2/8/01

Reply to Office action of June 7, 2004

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the Application:

Listing of the Claims

5 Pending Claims

1. (Currently amended): A process for the production of refinery transportation fuel or blending components for refinery transportation fuel, which process comprises:

10 providing a petroleum feedstock comprising a mixture of hydrocarbons, sulfur-containing and nitrogen-containing organic compounds, the mixture having a gravity ranging from about 10° API to about 75° API;

15 fractionating the petroleum feedstock by distillation to provide at least one low-boiling blending component consisting of a sulfur-lean, mono-aromatic-rich fraction, and a high-boiling oxidation feedstock consisting of a sulfur-rich, mono-aromatic-lean fraction;

20 contacting the high-boiling oxidation feedstock with a soluble quaternary ammonium salt containing halogen, sulfate, or bisulfate anion, and an immiscible aqueous phase comprising a source of hydrogen peroxide, and at least one member of the group consisting of phosphomolybdic acid and phosphotungstic acid, in a liquid reaction mixture under conditions suitable for reaction of one or more of the sulfur-containing and/or nitrogen-containing organic compounds;

25 separating from the reaction mixture both an essentially organic liquid and at least a portion of the immiscible aqueous phase with oxidation products of one or more of the sulfur-containing and/or nitrogen-containing organic compounds;

30 treating at least a portion of the separated organic liquid by contact with at least one immiscible liquid comprising a solvent having a dielectric constant in a range from about 24 to about 80 suitable to

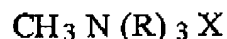
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selectively extract oxidized sulfur-containing and/or nitrogen-containing organic compounds; and

recovering from the treated organic liquid a product comprising a mixture of organic compounds containing less sulfur and/or less
5 nitrogen than the high-boiling oxidation feedstock.

2. (Currently amended): The process according to claim 1 wherein the soluble quaternary ammonium salt is represented by formula

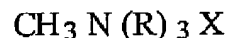


10 where X is a ~~halogen~~, sulfate, or bisulfate anion, and the R's are the same or different hydrocarbon moieties of at least 4 carbon atoms.

3. (canceled)

4. (Original): The process according to claim 1 wherein the immiscible aqueous phase consists essentially of water, a source of
15 hydrogen peroxide, and phosphotungstic acid.

5. (Currently amended): The process according to claim 4 wherein the soluble quaternary ammonium salt is represented by formula



20 where X is a ~~chlorine anion~~ or sulfate anion, and the R is a hydrocarbon moiety of about 7 to about 10 carbon atoms.

6. (Currently amended): The process according to claim 1 wherein the recovering of product from the treated organic liquid includes use of at least one solid sorbent comprising silica, and at least
25 a portion of the separated aqueous phase with oxidation products of one or more of the sulfur-containing and/or nitrogen-containing organic compounds is recycled to the reaction mixture.

7. (Previously presented): The process according to claim 6 wherein all or at least a portion of the petroleum feedstock is a

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product of a hydrotreating process for petroleum distillate consisting essentially of material boiling between about 50° C. and about 425° C. which hydrotreating process includes reacting the petroleum distillate with a source of hydrogen at hydrogenation conditions in the presence
5 of a hydrogenation catalyst to assist by hydrogenation removal of sulfur and/or nitrogen from the hydrotreated petroleum feedstock.

8. (Previously presented): The process according to claim 7 further comprising treating the immiscible aqueous phase separated from the reaction mixture to remove at least a portion of the sulfur-
10 containing and/or nitrogen-containing organic compounds, recycling the treated aqueous phase to the reaction mixture, and blending at least a portion of the low-boiling blending component with the product containing less sulfur and/or less nitrogen than the high-boiling oxidation feedstock to obtain a component for refinery blending of
15 transportation fuel.

9. (Previously presented): The process according to claim 7 wherein the high-boiling oxidation feedstock consists essentially of material boiling between about 200° C. and about 425° C.

10. (Previously presented): The process according to claim
20 7 wherein the conditions of oxidation include temperatures in a range upward from about 25° C. to about 250° C. and sufficient pressure to maintain the reaction mixture substantially in a liquid phase.

11. (Currently amended): A process for the production of refinery transportation fuel or blending components for refinery
25 transportation fuel, which process comprises:

hydrotreating a petroleum distillate consisting essentially of material boiling between about 50° C. and about 425° C. by a process which includes reacting the petroleum distillate with a source of hydrogen at hydrogenation conditions in the presence of a
30 hydrogenation catalyst to assist by hydrogenation removal of sulfur and/or nitrogen from the hydrotreated petroleum distillate;

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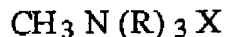
fractionating the hydrotreated petroleum distillate by distillation to provide at least one low-boiling blending component consisting of a sulfur-lean, mono-aromatic-rich fraction, and a high-boiling oxidation feedstock consisting essentially of a sulfur-rich, mono-aromatic-lean
5 fraction boiling between about 200° C. and about 425° C.;

contacting the high-boiling oxidation feedstock with a soluble quaternary ammonium salt containing ~~halogen~~, sulfate, or bisulfate anion, and an immiscible aqueous phase comprising a source of hydrogen peroxide, and at least one member of the group consisting of
10 phosphomolybdic acid and phosphotungstic acid, in a liquid reaction mixture under conditions suitable for reaction of one or more of the sulfur-containing and/or nitrogen-containing organic compounds and extraction of oxidation products from treated feedstock;

separating from the reaction mixture an essentially organic
15 liquid and at least a portion of the immiscible aqueous phase comprising oxidation products of one or more of the sulfur-containing and/or nitrogen-containing organic compounds; and

treating at least a portion of the recovered organic liquid with a solid sorbent, an ion exchange resin, and/or a suitable immiscible
20 liquid containing a solvent or a soluble basic chemical compound, to obtain a product containing less sulfur and less nitrogen than the oxidation feedstock.

12. (Currently amended): The process according to claim 11 wherein the soluble quaternary ammonium salt is represented by
25 formula



where X is ~~selected from the group consisting of chlorine anion and a sulfate anion~~, and the R is a hydrocarbon moiety of about 7 to about 10 carbon atoms.

30 13. (Original): The process according to claim 12 wherein the immiscible aqueous phase consists essentially of water, a source of hydrogen peroxide, and phosphotungstic acid.

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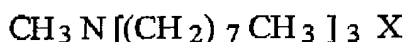
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14. (Currently amended): The process according to claim 13 wherein at least a portion of the separated aqueous phase with oxidation products of one or more of the sulfur-containing and/or nitrogen-containing organic compounds is treated to remove at least a
5 portion of the oxidation products therefrom, and thereafter is recycled to the reaction mixture.

15. (Previously presented): The process according to claim 12 wherein the treating of recovered organic liquid includes use of at least one immiscible liquid comprising a solvent having a dielectric
10 constant in a range from about 24 to about 80 suitable to selectively extract oxidized sulfur-containing and/or nitrogen-containing organic compounds.

16. (Original): The process according to claim 15 wherein the solvent comprises a compound selected from the group consisting of
15 water, methanol, ethanol and mixtures thereof.

17. (Currently amended): The process according to claim 11 wherein the soluble quaternary ammonium salt is represented by formula



20 where X is ~~selected from the group consisting of chlorine anion and a sulfate anion,~~ and the immiscible aqueous phase consists essentially of water, a source of hydrogen peroxide, and phosphotungstic acid.

18. (Original): The process according to claim 17 wherein the treating of recovered organic liquid includes use of at least one solid
25 sorbent comprising silica.

19. (Previously presented): The process according to claim 18 further comprising treating the immiscible aqueous phase separated from the reaction mixture to remove at least a portion of the sulfur-containing and/or nitrogen-containing organic compounds, recycling
30 the treated aqueous phase to the reaction mixture, and blending at

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least a portion of the low-boiling fraction with the product containing less sulfur and less nitrogen than the oxidation feedstock to obtain components containing less than about 50 parts per million of sulfur for refinery blending of a transportation fuel.

5 Claim 20. (canceled)

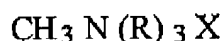
Claim 21. (canceled)

22. (Currently amended): A process for the production of refinery transportation fuel or blending components for refinery transportation fuel, which process comprises:

10 hydrotreating a petroleum distillate consisting essentially of material boiling between about 50° C. and about 425° C. by a process which includes reacting the petroleum distillate with a source of hydrogen at hydrogenation conditions in the presence of a hydrogenation catalyst to assist by hydrogenation removal of sulfur
15 and/or nitrogen from the hydrotreated petroleum distillate;

fractionating the hydrotreated petroleum distillate by distillation to provide at least one low-boiling blending component consisting of a sulfur-lean, mono-aromatic-rich fraction, and a high-boiling oxidation feedstock consisting essentially of a sulfur-rich, mono-aromatic-lean
20 fraction boiling between about 200° C. and about 425° C.;

contacting the high-boiling oxidation feedstock with a soluble quaternary ammonium salt represented by formula



25 where X is a halogen, sulfate, or bisulfate anion, and the R's are the same or different hydrocarbon moieties of at least 4 to about 10 carbon atoms, and an immiscible aqueous phase comprising a source of hydrogen peroxide, and at least one member of the group consisting of phosphomolybdic acid and phosphotungstic acid, in a liquid reaction mixture under conditions suitable for reaction of one or more of the
30 sulfur-containing and/or nitrogen-containing organic compounds and extraction of oxidation products from treated feedstock;

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separating from the reaction mixture an essentially organic liquid and at least a portion of the immiscible aqueous phase comprising oxidation products of one or more of the sulfur-containing and/or nitrogen-containing organic compounds; and

- 5 treating at least a portion of the recovered organic liquid with a ~~solid sorbent, an ion exchange resin, and/or a~~ suitable immiscible aqueous liquid containing a solvent or a soluble basic chemical compound, to obtain a product containing less sulfur and less nitrogen than the oxidation feedstock.

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